CREATING AND ANALYZING MUSIC WITH PYTHON

Jason Wangsadinata

FIRST AND FOREMOST…

▸ A very big thank you for PyCon ID staff and all the sponsors for making this event happen.

▸ Also, thank you PERKODI, SurabayaPy and PENS for supporting this event and hosting it here in the beautiful city of Surabaya.

▸ Also, a very big thank you to the PyCon ID committee for allowing me to speak at this event

A LITTLE BIT ABOUT MYSELF

▸ Sound engineer and Musician

▸ Recipient of NAMM President's Innovation Award 2014

▸ Korg MicroMadness Video Contest winner

▸ Currently a Software Engineer at Traveloka

PROGRAMMING MUSIC

▸ How is music represented?

▸ What can we do with musical data?

▸ How to read and store data?

▸ What sorts of interesting questions can we ask?

WHY PYTHON?

▸ A lot of wonderful libraries available

▸ Easy to get started and easy to use

▸ Great for testing out your ideas and make quick prototype

HOW CAN YOU GET STARTED?

▸ Explore the libraries that are available

▸ Make some projects

▸ Helps to check out what the community is doing

LIBRARIES

PYSYNTH

▸ A suite of simple music synthesizers written in Python 3

▸ Compose music based on note and duration

▸ Helper scripts that turn ABC notation/MIDI files into a WAV file

▸ Provided under the GPL

DEMO

MUSIC21

▸ Python-based toolkit for computer-aided musicology

▸ Help you with questions about music theory through the use of computers

▸ Large datasets of music

▸ Compose music algorithmically/directly

▸ Licensed under LGPL/BSD License
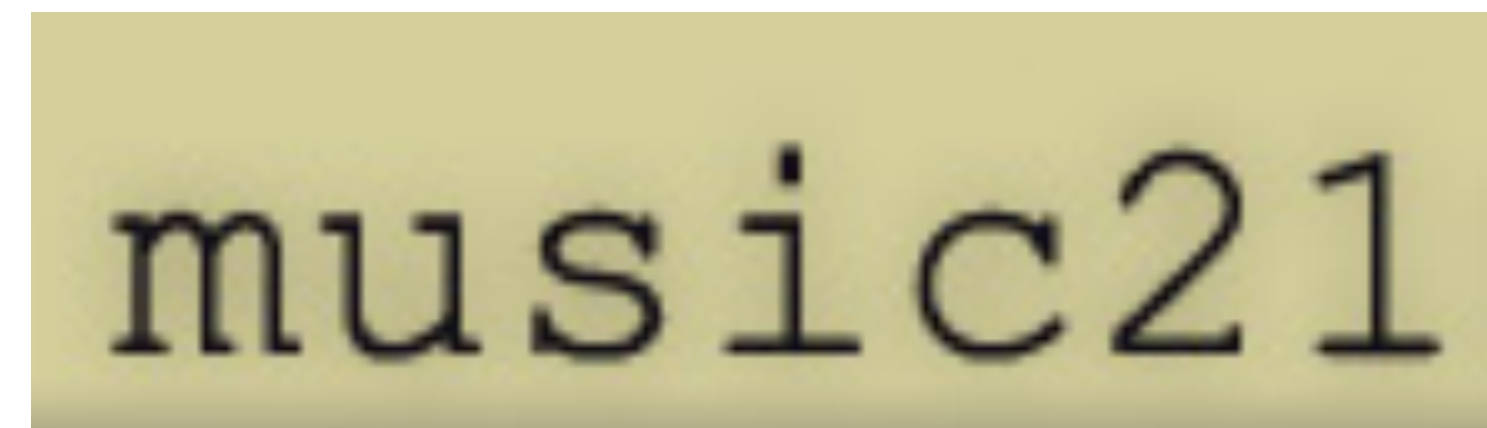
DEMO

LIBROSA

▸ Python package for music and audio analysis

▸ Focuses more on music information retrieval systems

▸ Great tool for audio processing, dynamic time warping, spectral representation and magnitude scaling

▸ Licensed under the ISC License

DEMO

MORE INFORMATION

▸ https://mdoege.github.io/PySynth/

▸ http://web.mit.edu/music21/

▸ https://librosa.github.io/

▸ https://wiki.python.org/moin/PythonInMusic

PROJECTS

THE IMPORTANT THING IS NOT TO STOP QUESTIONING. CURIOSITY HAS ITS OWN REASON FOR EXISTING.

Albert Einstein

TONEFINDER

▸ What if I can ask a computer to find out what is the key signature of a song?

▸ Very simple project ~ 50 lines of code (including comments)

▸ A pretty decent accuracy ~ 70%

▸ Libraries used:

   ▸ `madmom`

    ▸ `numpy, scipy`

DEMO

CHORD DETECTION

▸ How can you make a software that detects the chord that you play?

▸ How can you read an information from MIDI stream, and translate it to something useful?

▸ Another simple project, < 100 lines of code

▸ Libraries used:

    ▸ `python-rtmidi`

    ▸ `music21`

DEMO

NETWORKS IN MUSIC

‣ How can you better understand the musical relation using network analysis?

‣ Analyze the MIDI data of the song September by Earth, Wind and Fire, which consists of 15 different tracks

‣ Create a representation of note and note movement in a graph, where the notes are the vertices and note movements are the directed edges

‣ Use Girvan-Newman Algorithm - form clusters based on the edges that are most likely between communities
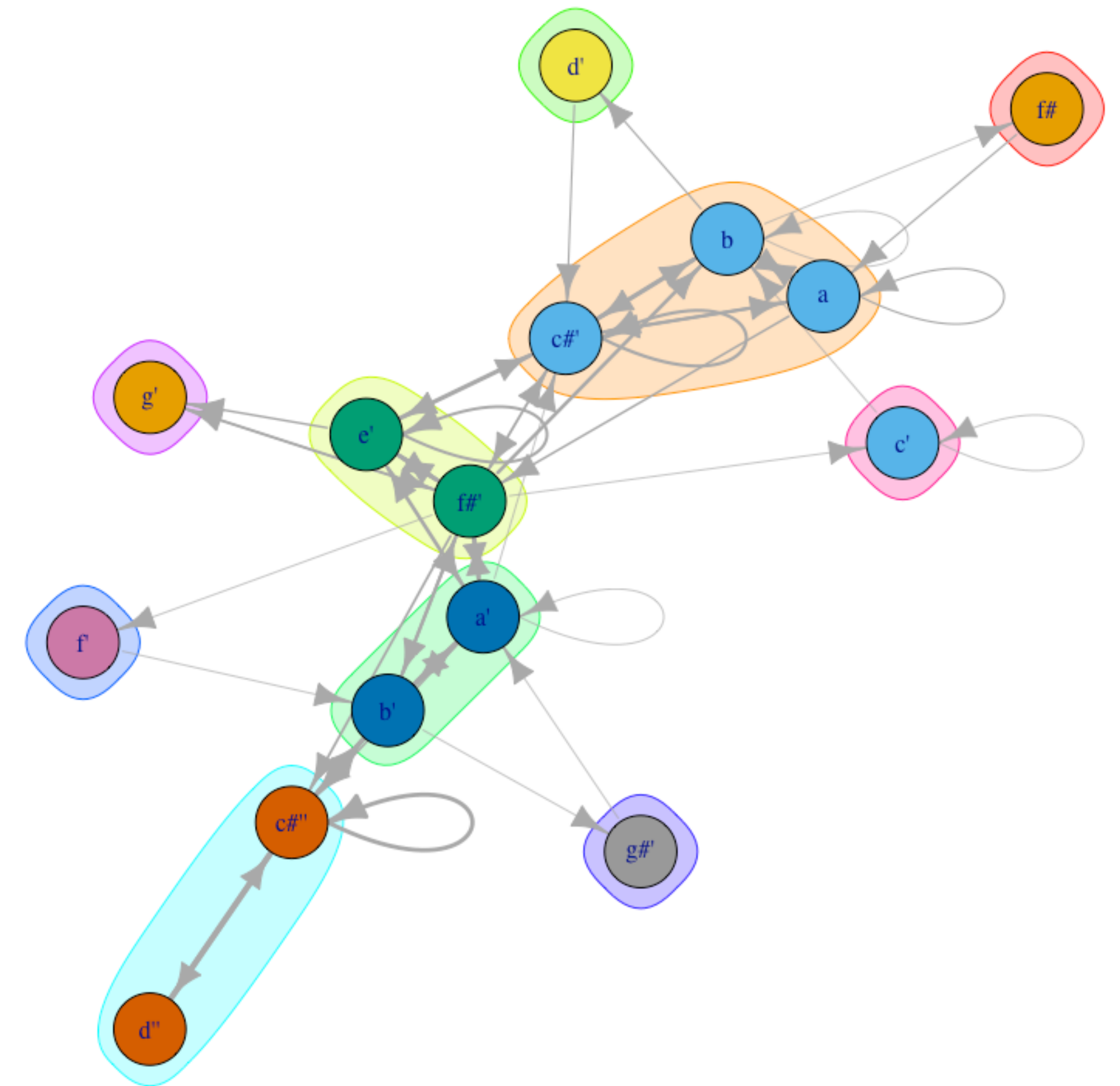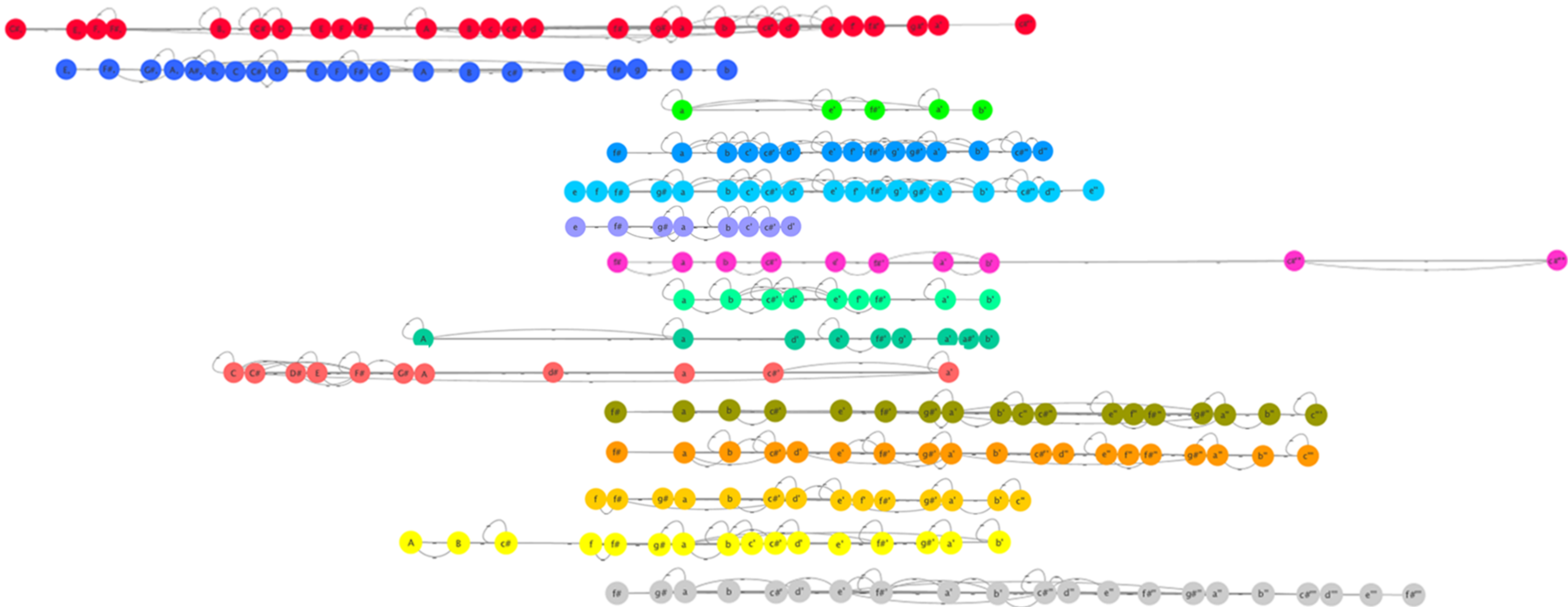
‣ This project is actually done in R
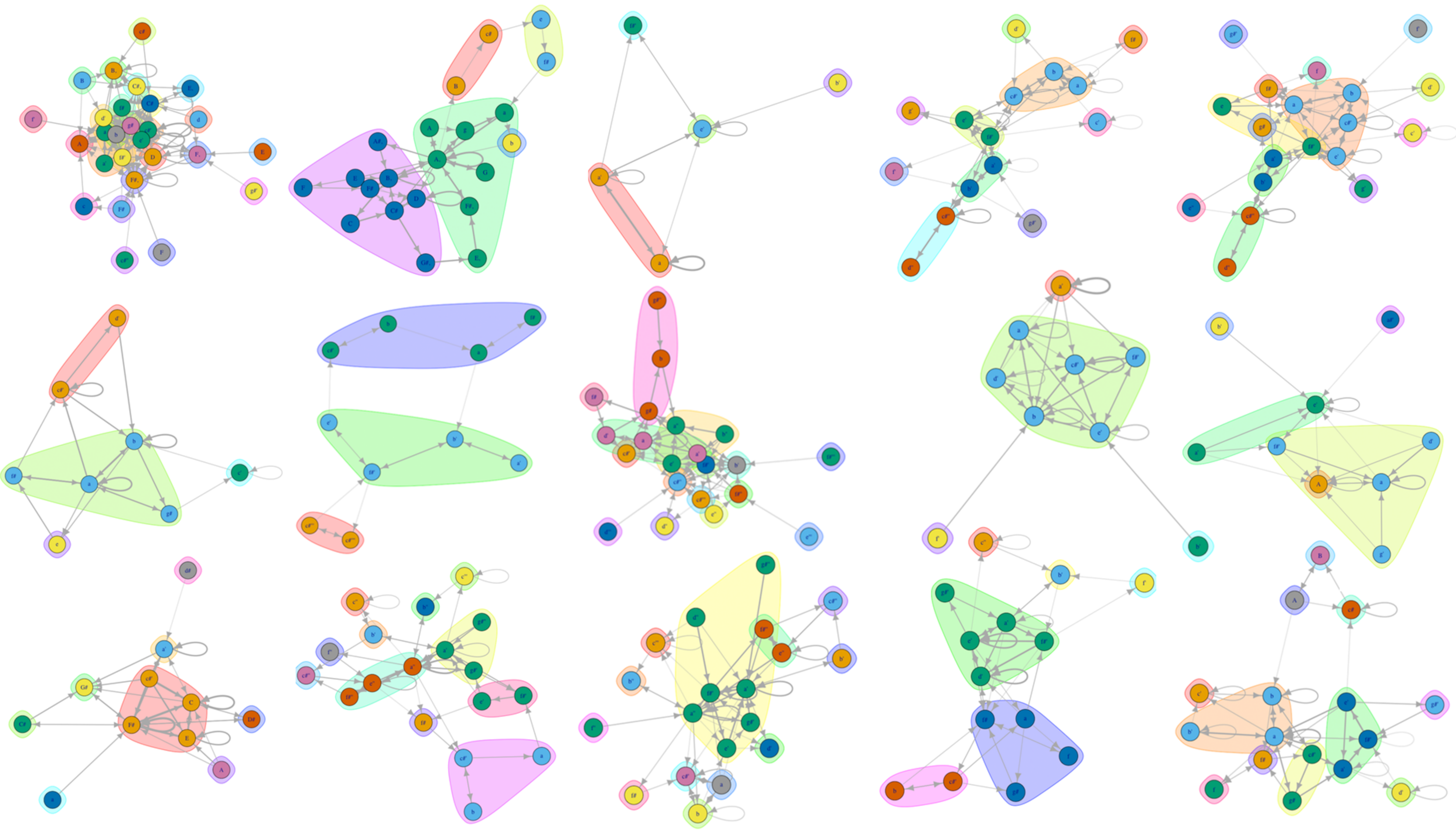
NETWORKS IN MUSIC (CONTINUED)

▸ An example network from main melody

▸ Network reveals the melody movements

▸ Thickness of edges represent frequency of the particular note movements

▸ f#, d', f', g#' are used as a passing note

▸ Network also shows separation of the verse and chorus of the song

PATTER

▸ One day project that I worked on with a few friends from college for Spotify Music Hackathon

▸ Music generation from visual patterns

▸ The app was build using Pure Data (Pd) for sound generation, and JavaScript for the visual feedback

▸ https://github.com/weshack/patter

LEARNING FROM OTHERS

CONTOURVIZ

‣ How do you visualize the information provided by musical melodies?

‣ A project by Christopher Witulski (cjwit) based on music21 and d3.js

‣ Create a web-based visualization of the melodic contours of the song

‣ https://github.com/cjwit/contourviz
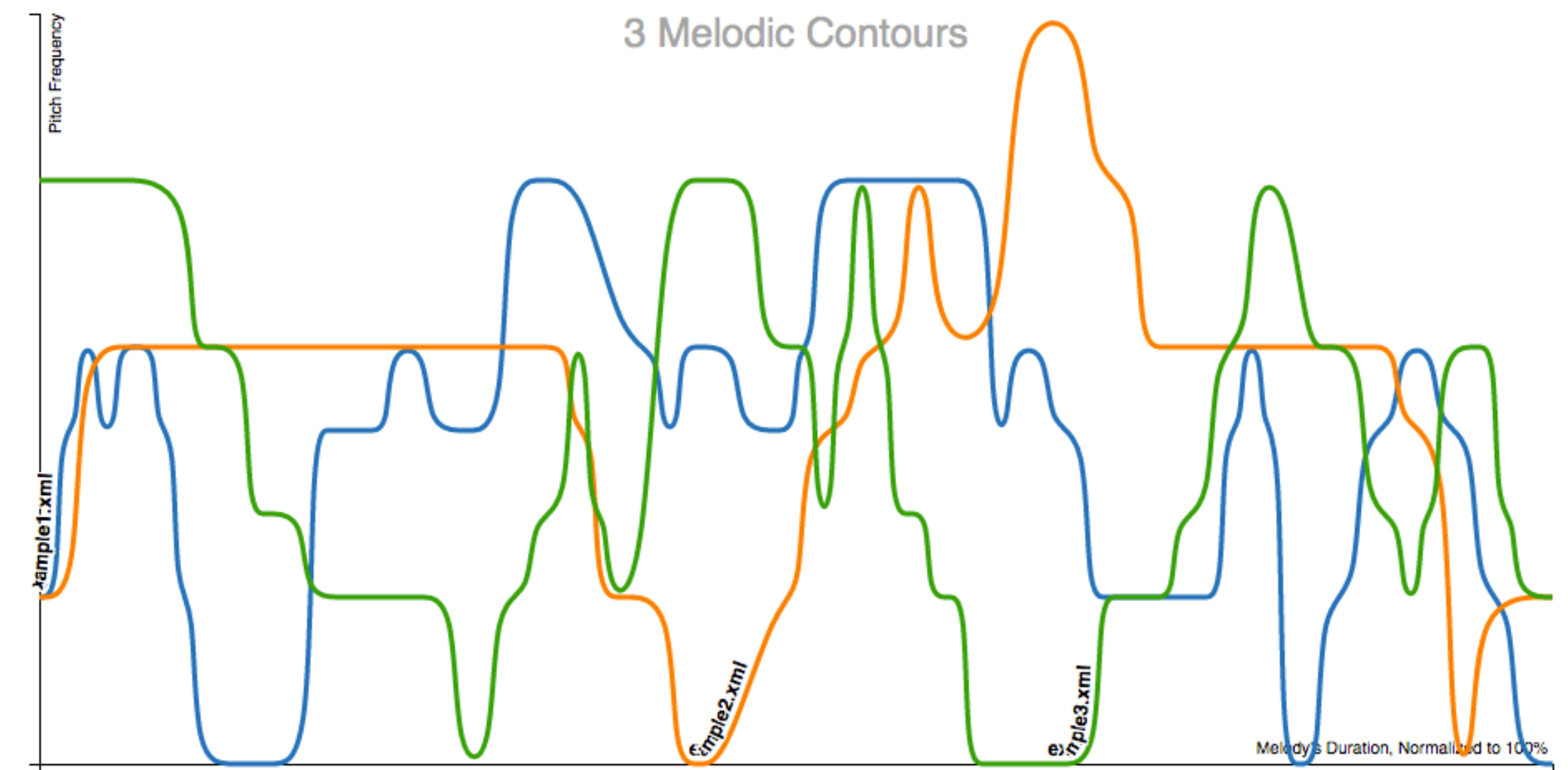
RTMONOAUDIO2MIDI

▸ How can you convert a live audio recording into a musical notation?

▸ Complex problem, current existing solution yield results with approximately 70% or less accuracy.

▸ A project by Anna Wszeborowska (aniawsz) of Ableton

▸ Heavy use of mathematical analysis, including Fast Fourier Transform (FFT), Spectral Flux, and quantization.

▸ https://github.com/aniawsz/rtmonoaudio2midi

A.I. DUET

‣ How does machine learning change the way we make music?

‣ An experiment that allows you to play a duet with the computer.

‣ A project by Yotam Mann with friends on the Magenta and Creative Lab teams at Google

‣ Built using TensorFlow, Flask, Tone.js and open-source tools from Magenta Project

‣ https://github.com/googlecreativelab/aiexperiments-ai-duet

THOUGHTS

THINGS I LEARNED

▸ Python is a wonderful tool to test out your idea and just build something out of it. It is still my go-to programming language for prototyping.

▸ Python has a lot of great libraries for you to get started.

▸ Making projects are one of the best ways for you to learn about a technology.

▸ We are fortunate that we have a lot of Python enthusiast here in Indonesia as well.

WORDS OF ADVICE

▸ Find something you are passionate about.

▸ Find a question/problem that you want to figure out the answer to.

▸ Do your best to solve it, and don't be afraid to ask for help.

▸ Collaborate. You can only do so much on your own.

▸ Never stop learning.

QUESTIONS?

THANK YOU

Jason Wangsadinata

Software Engineer, Traveloka

jwangsadinata@gmail.com

http://jwangsadinata.com

We're hiring - send me an email for more details